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(71) Applicant: THE FRANKLIN INSTITUTE [US/US]; 222 North 20th Street, Philadelphia, PA 19103 (US).

(72) Inventors: JONSSON, Arne; The Franklin Institute, 222 North 20th Street, Philadelphia, PA 19103 (US). TESTANI, Sandra; The Franklin Institute, 222 North 20th Street, Philadelphia, PA 19103 (US). WAGNER, Edward; The Franklin Institute, 222 North 20th Street, Philadelphia, PA 19103 (US). BURDICK, Josh; The Franklin Institute, 222 North 20th Street, Philadelphia, PA 19103 (US).

(74) Agent: BAILEY, Matthew, T.; Morgan, Lewis & Bockius LLP, 1800 M Street, N.W., Washington, DC 20036-5869 (US).

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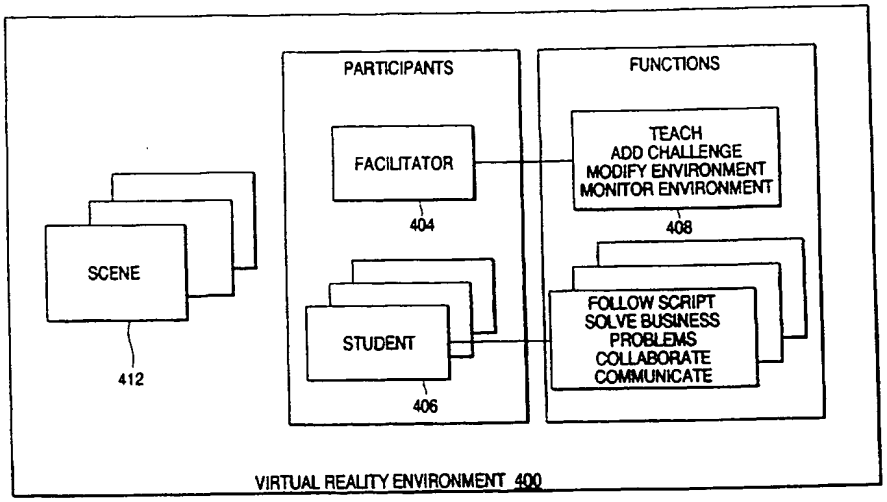

(57) Abstract

A virtual environment (400) for solving business-oriented problems by interactive-collaborative learning involving one or more participants (406) that are monitored by a facilitator (404). The virtual environment for facilitating collaborative decision-making is implemented on an interactive distributed network. Upon "entering" the virtual environment, each participant chooses a virtual persona or "avatar" and each participant may navigate through the virtual environment individually or with other participants. The facilitator guides and monitors participants' navigation through the virtual environment and the facilitator may prompt the participants to negotiate complex problems presented by a software application to reach collaborative decisions. Additionally, the facilitator may interact one-to-one with each participant or with a selective group of participants or with all of the participants. Each participant utilizes a three-dimensional application that is executed on a client computer system and the facilitator's functions and other functions relating to the virtual environment may be stored on a server computer.

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A System Containing A Multi-User Virtual Learning Environment

Field of the Invention

The present invention relates to a multi-user distributed interactive virtual reality environment, and more particularly, to a multi-user interactive virtual environment for collaborative learning through task-based group interaction monitored by a configurable project facilitator.

Background of the Invention

Advances in memory storage and processing capabilities for computer hardware, telecommunication networks, and multimedia technology have facilitated the development of distributed real-time virtual reality simulations in which users can interact with each other in a fashion that closely resembles actual reality. Improved Internet browser software supports three-dimensional graphics for computerized generation of "scenes," virtual representations of physical objects or locations. Thus, users of virtual reality programs on computers connected through dedicated networks or through the Internet can interact within a multi-user virtual reality environment.

Current network-based virtual reality applications, such as virtual three-dimensional maps for promoting tourism or computer-generated motion video for advertising, have generally been limited to single-user applications. While three-dimensional multi-user virtual reality environments are used in military simulations and animated / action and adventure computer games, there are no current facilitator-led three-dimensional multi-user virtual reality environments to address general and/or specific business needs. Moreover, existing multi-user virtual reality environments do

not provide a structure to effect collaborative interaction between participants and to guide participants to achieve team-oriented goals.

Summary of the Invention

The present invention relates to a virtual environment for solving business-oriented problems by interactive-collaborative learning involving one or more participants that are monitored by a facilitator. Upon "entering" the virtual environment, each participant chooses a virtual persona or "avatar" and each participant may navigate through the virtual environment individually or with other participants. The facilitator guides and monitors participants' navigation through the virtual environment and the facilitator may prompt the participants to negotiate complex problems presented by a software application to reach collaborative decisions. Additionally, the facilitator may interact one-to-one with each participant or interact with a selective group of participants or with all of the participants.

One feature of the present invention is to provide a virtual environment on a distributed network where participants executing three-dimensional applications on desktop computer systems are connected to each other and a facilitator via the network and the participants may communicate with each other and the facilitator through the network.

Another feature of the invention is to provide a configurable facilitator for modifying the virtual environment based on the participants' performance. The facilitator functions may be automated or controlled by 'real-time' human interaction and they may reside on a desktop computer system or a server system. The invention allows the facilitator to administrate interaction among and between each of the participants and to facilitate collaboration and joint decision-making by participants.

The facilitator may selectively communicate with one of the participants, with a selected group of the participants and/or with all of the participants. Additionally, the facilitator may selectively control navigation of one or more of the participants through the virtual environment.

Another feature of the invention is to provide a virtual environment where a computer system enables assignment of ownership of items by participants such that, the owner of each item may navigate the virtual environment in a particular way not otherwise navigable by other participants. Ownership of the items may be transferred directly between participants or through the facilitator and the facilitator may control acquisition of ownership of items. The computer system keeps track of ownership of each item in the virtual environment.

Another feature of the invention is to provide a virtual environment where the facilitator or the computer system controls aspects and/or elapsed time of the virtual environment. The computer system also maintains a state of each of the participants as they navigate through the virtual environment. Each participant's state includes the participant's location in the virtual environment, a list of items owned by the participant and a history of tasks completed by the participant. The facilitator accesses the state to administrate navigation of the corresponding participant.

Another feature of the invention is to provide a virtual environment where each participant is associated with an avatar and 'perceives' other avatars associated with other participants. The participants may selectively communicate with each other through the computer system or via the computer system through the Internet. The communication may include voice communication and gesturing.

An additional feature of the invention is to provide a virtual environment where the facilitator may selectively view the virtual environment through the perspective of at least one of the participants.

Yet another feature of the invention is to provide a virtual environment where the computer system receives information from a desktop computer system, distributes portions of the information to one or more other desktop computers and/or an automated or human facilitator and updates the virtual environment in accordance with the information. The information may include voice message, text message, a position update and request to acquire ownership in an item. The computer system may also receive information from the automated or human facilitator and selectively distribute the information to the desktop computer systems.

Yet still another feature of the present invention is to provide a virtual environment where participants, through natural speaking, selectively communicate on-line by means of electronic voice transmission.

Additional features and advantages of the invention will be set forth in part in the description that follows, and in part will be obvious from the description, or may be learned by practice of the invention.

To achieve the features and in accordance with the purpose of the invention, as embodied and broadly described herein, the invention comprises a multi-user distributed interactive virtual system comprising a computer system for generating and controlling a virtual environment; a plurality of user systems, coupled to the computer system, that communicate with one another through the computer system; and a facilitator system, coupled to the computer system, that administrates interaction among each of the plurality of user systems and between each the the plurality of user systems and the

plurality of user systems and between each the the plurality of user systems and the virtual environment.

Brief Description of the Drawings

The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention that together with the description serve to explain the principles of the invention.

In the drawings:

Fig. 1 illustrates a computer network in which the inventive multi-user virtual reality environment may be incorporated;

Fig. 2 illustrates an alternate embodiment of a computer network in which the inventive multi-user virtual reality environment may be incorporated;

Fig. 3 illustrates interactions between client components and server components on the computer network;

Fig. 4 illustrates components of the inventive virtual reality system; and

Fig. 5 illustrates a flow chart of an application that utilizes the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the present invention, participants in the virtual environment solve business problems by interactive collaboration with other participants and they are guided by a facilitator. Each participant utilizes a three dimensional virtual reality application that is executed on a desktop computer system in a distributed network. Upon "entering" the virtual environment, each participant chooses a virtual persona or "avatar" and the participant may navigate through the virtual environment individually or with other

participants. The facilitator monitors the participants as they navigate through the virtual environment and the facilitator may interact one-to-one with each participant or interact with a selective group of participants or with all of the participants.

Fig. 1 is an example of a local area network (LAN) 100 that is configured to connect components executing virtual reality programs; such that, users of the LAN components can interact within a shared virtual environment. LAN 100 may include a server 102, one or more desktop computer systems (illustrated as computer systems 104, 106, 108, 110) and peripherals such as printers and/or other devices 112 that may be shared by components on LAN 100. Computer systems 104-110 may serve as clients for server 102 and/or as clients and/or servers for each other and/or for other components connected to LAN 100. Components on LAN 100 may be preferably connected together by cable media, for example copper or fiber-optic cable, and LAN 100 typology may be a token ring topology 114. As would be apparent to those of ordinary skill in the art, other media, for example wireless media such as optical and radio frequency, may also connect components on LAN 100 and other network topologies such as Ethernet may be used.

Data may be transferred between components on LAN 100 in packets, i.e., blocks of data that are individually transmitted over LAN 100. Routers 120, 122 create an expanded network by connecting LAN 100 to other computer networks, such as, the Internet, other LANs or Wide Area Networks (WAN). Routers are hardware devices that may include a conventional processor, memory, and separate I/O interface for each network to which it connects. Hence, components on the expanded network may share information and services with each other. It should be noted that, computer systems 104-110 may be connected directly to other computer networks through modems or

other connection devices. Thus, computer systems 104-110 may share information and services with components on the computer networks. In order for communications to occur between components of physically connected networks, all components on the expanded network and the routers that connect them must adhere to a standard protocol. Computer networks connected to the Internet and to other networks typically use the TCP/IP Layering Model Protocol. It should be noted that other internetworking protocols may be used.

An alternate embodiment of a computer network 200 in which the present invention may be implemented is illustrated in Fig. 2. The computer network 200 includes multiple Intranets 204 and 2 06 each connecting desktop computer systems 208-218 to an expanded network and desktop computer systems 220-224. Routers connect Intranets 204-206 to the expanded network and desktop computer systems 220-224 are connected to the Internet 226 through modem 230. It should be noted that other connection means may be utilized. Desktop computer systems 208-218, 220 and 224 each serves as clients to desktop computer system 222 and system 222 serves as a server system to systems 208-218, 220 and 224. Components on the expanded network are connected to each other through physical media. As would be apparent, the client/server arrangement among desktop computer systems 208-224 may be modified.

In a preferred embodiment of the present invention, an interactive virtual-reality application resides on clients / desktop computer systems 104-110 or on server 102. Fig. 3 illustrates how components on a particular client 302 in the virtual reality environment interact with components on server 350. As illustrated in Fig. 3, client 302 may be connected to a JAVA™ based server 352 through a client controller 304. Interactive virtual-reality applications residing on JAVA™ based server 352 may be

executed by three-dimensional interactive applications on client 302 through JAVA™ Remote Method Invocation (RMI). To perform server-based functions on client 302, JAVA™ RMI enables objects executing on client 302 to invoke methods of objects on server 352. The invoked methods are thereafter executed on the server 352.

Each desktop computer system 104-110 may also include a desktop videoconferencing application and a camera 126-132. Client 302 exchanges non-Virtual Reality Model Languages (VRML) data with JAVA ™ based server 352. VRML supports three-dimensional graphics for computerized generation of virtual reality environments. A VRML Browser 306 exchanges VRML data with a VRML community server 354. Non-VRML information transmitted from client 302 may be stored in databases 358, 360 or 362 and community server 354 transmits VRML information stored in VRML databases 364 to VRML client 306. Client 302 additionally includes a voice-sound plug-in 314 for allowing users of the virtual reality environment to verbally communicate with each other. A voice environment sound server 366 may generate special voice propagation to users to simulate the relative positioning of each participant within the virtual environment. It should also be noted that voice compression and other methods for verbal communication between users in the virtual environment might also be used.

Users on desktop computer systems 104-110 may use Netscape Navigator ™ browser or 308 any other browser to access information on the World Wide Web (Web). Browser 308 may be connected to the expanded network through a second user interface 310. To display virtual environments on a desktop computer system 104-110, the second user interface 310 accesses locally stored VRML information 312 that may be pre-loaded on each desktop system 104-110. JAVA™ based server 352 may be

connected to a Hyper Text Transfer Protocol (HTTP) web server 356 for access to information on the web. Browser 308 accesses and displays Hyper Text Markup Language (HTML) documents on the web through the HTTP web servers.

Upon a user logging on to a desktop computer system 104-110, client 302 forwards the user authentication information to server 352 for storage in biographical database 358. Biographical database 358 stores, among other things, organized information corresponding to the results of exercises performed by users and users' profiles. All events triggered by the users are stored in databases 360-362 to maintain a complete audit of how the system is used.

According to the invention, virtual reality environment 400 is tailored to function as a template for solving business problems. Virtual reality environment 400 includes a facilitator 404 and one or more participants 406. The facilitator 404 guides and monitors the navigation of the participants through virtual reality environment 400 to prompt the participants to negotiate complex problems and reach collaborative decisions. Functions 408 of facilitator 404 include debriefing and/or teaching the participants, adding challenges to the virtual reality environment and/or modifying the environment. For example, facilitator 404 may describe a business problem and an associated exercise to the participant; time how long participants collaborate before a solution to the business function is found; move the participants to other locations in virtual environment 400 and increase or decrease the difficulty of each exercise based on the participants' performance. Functions 408 of facilitator 404 may be automated or controlled by "real-time" human interaction. Participants 406 in environment 400 follow a script and they may monitor each other or be monitored by the facilitator 404 to ensure collaboration in arriving at a solution to a business problem. Additionally

participants 406 must collaborate and communicate to solve simulated exercises in virtual environment 400. Skills developed by participants 406 in environment 400 are applicable to solving real-time business problems/issues.

Each participant 406 and facilitator 404 in environment 400 chooses his/her own virtual persona or "avatar". To heighten the sense of realism, pictures of the participants' faces may be mapped onto the avatar bodies. Environment 400 is divided into virtual reality scenes 412 where all participants reside. While participants 406 usually reside within the same virtual reality scene, a participant may individually navigate within the same virtual scenes. Facilitator 404 may also move participants within the same scene and/or into and out of scenes individually or as a group. Facilitator 404 may generate commands either through automation or human interaction to move the participants 406 along to subsequent scenes. Participants 406 may also move to subsequent scenes or scenes in environment 400 in response to actions by an individual participant, by the group, or by the facilitator.

When the facilitator functions 408 are performed through human interaction, options for modifying environment 400 are continually presented to the facilitator 404. For example, facilitator 404 may increase or decrease the level of difficulty of each exercise based on the performance of participants 406. Facilitator 404 may also 'listen' to dialogue between the participants, and when they are confronted with additional challenges, and facilitator 404 may move the participants 406 to other scenes and/or wait until an event occurs before commencing the next scene. Upon monitoring interaction among participants, facilitator 404 may selectively communicate with each participant, with a group of participants or with all of the participants. For example, during an exercise, if facilitator 404 determines that a particular participant is having a

problem, facilitator 404 may provide one-on-one attention to that participant or instruct other participants or groups of participants on how the help the participant with the problem.

By controlling functions 408 of facilitator 404 through real-time human interaction, the present invention enables dynamic operation flows, i.e., exercises are implemented based on real-time interaction with human. Thus, the invention offers an advantage over script operations of three-dimension games where the flows of these games are predetermined by predefined decisions in the script. Hence, the flow of exercises in environment 400 is dynamic and subject to input from facilitator 404.

The facilitator concept enables the multi-user virtual environment 400 to serve as a learning tool. This concept gives participants 406 partial control to navigate through environment 400 in accordance with facilitator 404. Facilitator 404 has privileged access to control the virtual environment 400 in order to create a learning environment. Examples of applications that may lend themselves to this mode of learning include hazardous materials training, precision manufacturing, plant operations, military command and control, military field training, and group engineering and design applications. Thus, the facilitator 404 adds a structure to VRML technology that affects collaborative learning between participants and guides participants to achieve team-oriented goals over and above script-operation of three-dimensional games.

According to the invention, functions 408 of facilitator 404 and functions associated with events in the business exercise are stored on server 350. It should be noted that functions 408 of facilitator 404 may also be stored on a desktop computer system / client 302. Server 350 maintains the states of each participant 406 as they navigate through the virtual environment. Each participant's state includes the

participant's location in the virtual environment, a list of items owned by the participant and a history of tasks completed by the participant. The history of each participant's task is stored in databases 360-362 to maintain a complete audit of how the system is used. The facilitator accesses each participant's state on the server to administrate navigation of the corresponding participant.

When a new scene 412 is transmitted to each client 302 (loaded into the memory area on each desktop computer 104-110), triggers automatically are set for the next scene. Upon the occurrence of a trigger, client 302 forwards a request to JAVA™ based server 352, which then instructs client 302 to load VRML data (from client 302 hard drive or community server 354). All activities are stored into the event or transaction database 360-368 for later evaluation of the business exercise.

While an example of a virtual reality application is presented below to illustrate features of the inventive system, it should be understood that numerous applications may be applied to this invention and the scope of this invention is not confined to a particular application, scenario or role-playing exercise. Fig. 5 illustrates a flowchart of a virtual reality application that utilizes the present invention. The application revolves around a team of employees from a fictional company. The team is challenged to travel to a bridge site in a distant city where construction of a bridge has stopped because of the differing needs of a variety of neighborhood, political, and business stakeholders. The team must determine what caused the stoppage and present a solution to continue construction of the bridge.

Planning for the project and the journey itself presents a variety of opportunities for the team to exercise communication, listening, and information sharing skills. The team members in this application must share responsibilities, use collaborative decision

making and problem solving skills, and build conflict management skills. After a workable solution is found, the team members virtually complete the bridge. To increase the complexity of the challenges presented to the team, as the team moves through the virtual environment, the facilitator may escalate the degree of difficulty in each scene. For example, the facilitator may place a road block on a virtual road to the bridge to test information sharing between team members.

In Step 510, upon entering the virtual reality environment, each participant avatar enters a virtual three-dimensional lobby where a receptionist "bot", a system generated animated object, plays a prerecorded welcoming message. The receptionist bot 'instructs' the participants to visit different virtual rooms where information about the role-playing exercise and the process of collaborative decision making, conflict management, and methods of negotiating are presented. In Step 520, each participant avatar is instructed to roam through some of the virtual scenes to become comfortable with the virtual environment and to later return to the virtual lobby to begin a business exercise.

In Step 530, each participant avatar enters into a virtual practice room where a tutorial on how to navigate virtual locations and communicate with other avatars is presented. For example, avatars learn how to take possession of virtual objects and transfer virtual objects to other avatars, drive a virtual automobile, and communicate with other avatars, either through private conversations with another avatars, semi-private conversations with portions of the group, or a group-wide discussion. Users of the system also learn about menu features, such as a help button, a timer, inventory boxes, and a status bar (health, rest and food), that appear on each desktop computer screen.

In Step 540, participant avatars are instructed to enter a virtual conference room. When the last avatar enters, the business exercise begins. At this point, the users represented by the participant avatar hear a voice that is associated with the facilitator avatar. This speech, either electronicically generated or spoken by a human instructor, introduces the users to the business problem. In Step 550, the facilitator avatar then assigns the participant avatars to roles which include a community relations manager, a finance manager, a marketing manager, an operations manager, a human resources manager, and a sales manager. Each role within the fictional corporation entails a variety of inter-company politics to add reality to the business exercise.

In Step 560, the facilitator avatar introduces shared responsibilities and items, represented by icons, to the participants' avatars by triggering the system. Examples of icons may include a cell phone icon, a debit card icon, a travel map icon, and an employee manual icon. The cell phone icon may be used to make calls during the journey, the debit card icon may be used to pay for the participants' virtual overnight stay and meals. The travel map icon may be used to guide the participants to the virtual construction site and the employee manual icon may be used to explain the company's policies on personal resources (meals and rest stops), cell phone usage, appropriate usage and balance of the debit card, and the bonus plan at the company. The items may be divided among the participant avatars and the participants are given a certain amount of time to decide which participant is responsible for a particular item. The facilitator monitors communications between the participants, and if they are unsuccessful in this task, the facilitator enters the virtual environment on each desktop computer and assists the user on that computer in negotiating through the task. If necessary, i.e., there is no

agreement among the participants, the facilitator may assign items to each participant avatar.

In Step 570, the facilitator starts a discussion of travel planning issues. The participants must jointly decide, from a list of available choices, on which type of vehicle to rent, insurance coverage to buy and route to travel. Again in Step 580, the facilitator monitors the participants' collaboration during discussions associated with the travel planning decisions, and is able to interject to assist, provide guidance and/or impose a particular solution.

Upon receiving a call informing them that their virtual car is ready, the facilitator instructs the participants to begin the journey. The journey to the bridge site destination is designed to function as a communication and joint decision-making exercise, monitored by the facilitator. The participants may confront several possible challenges, depending in part upon the facilitator's judgment regarding the prudence of the participants' collective decisions. For example, the participants may be detained by a police officer bot for opting to travel beyond the legal speed limit, which will consume their time and financial resources. Along the journey, the participants may encounter obstacles including flooding conditions, traffic, road construction, hunger and sickness requiring a hospital visit. The participants may also be forced to stop for fuel, rest stops and food at inopportune times. The role of the facilitator is to impose an optimal number of obstacles, according to the skill levels demonstrated by the participants, to provide opportunities for the participants to practice managing business conflicts.

As the participant avatars navigate through the virtual environment, each participant must keep track of his/her assigned item, for example, the debit card icon. The server system also keeps track of each object and the resources available therein.

The facilitator monitors conversations among the participants to examine the level of information sharing and the facilitator evaluates the quality of the participants' discussions for accessing each participant's progress. In Step 590, when the participants successfully reach the work site, a site manager provides background about the issues that relate to the work stoppage. The participants are asked to meet with all parties and devise a solution. Locations at the work site, for example, virtual trailers, are provided for the participants to hold discussions with the opposing groups. After hearing each of the issues, the team gathers in another location and decides upon a course of action. Again, the facilitator monitors this discussion for later evaluation. In Step 600, after the site manager approves the plan, the team moves to the cranes and watches as the virtual bridge is successfully constructed. Upon the conclusion of the project, the participants return to the initial virtual conference room with the facilitator to debrief and discuss the exercise.

The foregoing description has been directed to specific embodiments of this invention. It will be apparent, however, that other variations and modifications may be made to the described embodiments, with the attainment of some or all of their advantages. Therefore, it is the object of the appended claims to cover all such variations and modifications as come within the true spirit and scope of the invention.

Claims:

1. A multi-user, distributed, interactive, virtual reality system comprising:

a computer system for generating and controlling a virtual environment;

a plurality of user systems, coupled to said computer system, that communicate with one another through the computer system; and

a facilitator system, coupled to said computer system, that administrates interaction among each of said plurality of user systems and between each of said plurality of user systems and the virtual environment.

2. The system of claim 1, wherein said facilitator system selectively communicates with one of said plurality of user systems.

3. The system of claim 1, wherein said facilitator system selectively communicates with a portion of said plurality of user systems.

4. The system of claim 1, wherein said facilitator system selectively communicates with all of said plurality of user systems.

5. The system of claim 1, wherein said facilitator system selectively controls navigation of one of said plurality of user systems through the virtual environment.

6. The system of claim 1, wherein said facilitator system selectively controls navigation of said plurality of users systems through the virtual environment.

7. The system of claim 1, wherein said facilitator system controls aspects of the virtual environment.

8. The system of claim 1, wherein said computer system controls aspects of the virtual environment.

9. The system of claim 7, wherein said facilitator system controls an elapsed time in the virtual environment.

10. The system of claim 1, wherein each of said plurality of user systems navigates in the virtual environment from a particular perspective.

11. The system of claim 10, wherein each of said plurality of user systems is represented as an avatar in the virtual environment.

12. The system of claim 11, wherein one of said plurality of user systems perceives an avatar associated with another one of said plurality of user systems.

13. The system of claim 10, wherein said facilitator system selectively views a particular perspective of at least one of said plurality of user systems.

14. A method in a multi-user, distributed, interactive, virtual reality system comprising a computer system, a plurality of user systems, coupled to said computer system and a facilitator system, coupled to said computer system, said method comprising the steps of :

generating and controlling a virtual environment by said computer system;

communicating between said plurality of user systems through said computer system; and

administrating through said facilitator system interaction among each of said plurality of user systems and between each of said plurality of user systems and the virtual environment.

15. The method of claim 14 further comprising the step of selectively communicating between said facilitator system and one of said plurality of user systems.

16. The method of claim 14 further comprising the step of selectively communicating between said facilitator system and a portion of said plurality of user

systems.

17. The method of claim 14 further comprising the step of selectively communicating between said facilitator system and all of said plurality of user systems.

18. The method of claim 14 further comprising the step of selectively controlling through said facilitator system navigation of one of said plurality of user systems through the virtual environment.

19. The method of claim 14 further comprising the step of selectively controlling through said facilitator system navigation of said plurality of users systems through the virtual environment.

20. The method of claim 14 further comprising the step of controlling through said facilitator system aspects of the virtual environment.

21. The method of claim 14 further comprising the step of controlling through said computer system aspects of the virtual environment.

22. The method of claim 20 further comprising the step of controlling through said facilitator system an elapsed time in the virtual environment.

23. The method of claim 14 further comprising the step of navigating by each of said plurality of user systems through the virtual environment.

24. The method of claim 23 further comprising the step of representing each of said plurality of user systems as an avatar in the virtual environment.

25. The method of claim 24 further comprising the step of perceiving by one of said plurality of user systems an avatar associated with another one of said plurality of user systems.

26. The method of claim 23 further comprising the step of selectively viewing through said facilitator system a particular perspective of at least one of said plurality of user systems.

27. A multi-user, distributed, interactive, virtual reality system comprising:

a computer system for generating and controlling a virtual environment;

an item in the virtual environment having characteristics associated with ownership; and

a plurality of user systems, coupled to said computer system, that are capable of owning said item.

28. The system of claim 27, wherein an owning one of said plurality of user systems acquires ownership of said item.

29. The system of claim 28, wherein ownership of said item permits said owning one of said plurality of user systems to navigate the virtual environment in a particular way not otherwise navigable by any other of said plurality of user systems.

30. The system of claim 28, further comprising a facilitator system, coupled to said computer system, that grants one of said plurality of user systems ownership of said item.

31. The system of claim 28, further comprising a facilitator system, coupled to one of said plurality of user systems, that grants one of said plurality of user systems ownership of said item.

32. The system of claim 28, wherein ownership of said item is transferred directly to another one of said plurality of user systems.

33. The system of claim 28, wherein ownership of said item is transferred directly to another one of said plurality of users systems by said owning one of said plurality of said user systems.

34. The system of claim 28, further comprising a facilitator system, coupled to said computer system, that transfers ownership of said item directly from said owning one of said plurality of user systems to another one of said plurality of user systems.

35. The system of claim 28, further comprising a facilitator system, coupled to one of said plurality of user systems, that transfers ownership of said item directly from said owning one of said plurality of user systems to another one of said plurality of user systems.

36. The system of claim 28, further comprising a facilitator system, coupled to said computer system, that controls acquisition of ownership of said item by said owning one of said plurality of user systems.

37. The system of claim 28, further comprising a facilitator system, coupled to one of said plurality of user systems, that controls acquisition of ownership of said item by said owning one of said plurality of user systems.

38. The system of claim 28, wherein said computer system tracks ownership of said item in the virtual environment.

39. The system of claim 27, wherein examples of icons of said items include one of a key, a payment instrument, a telecommunications device, and a map.

40. An owning method in a multi-user, distributed, interactive, virtual reality system comprising a computer system, a plurality of items representing physical objects and a plurality of user systems coupled to said computer system, said method comprising the

steps of:

generating and controlling said virtual environment through said computer system; and

associating ownership of said plurality of items in said virtual environment with said plurality of system users.

41. The method of claim 40, further comprising the step of acquiring ownership of one of said plurality of items by an owning one of said plurality of user systems.

42. The method of claim 40, further comprising the step of permitting said owning one of said plurality of user systems to navigate the virtual environment in a particular way not otherwise navigable by any other of said plurality of user systems.

43. The method of claim 40, further comprising the step of granting one of said plurality of user systems ownership of said item by a facilitator system, coupled to said computer system,.

44. The method of claim 40, further comprising the step of granting one of said plurality of user systems ownership of said item by a facilitator system, coupled to said one of said plurality of user systems.

45. The method of claim 40, further comprising the step of transferring ownership of said item directly to another one of said plurality of user systems.

46. The method of claim 45, further comprising the step of transferring ownership of said item directly to another one of said plurality of users systems by said owning one of said plurality of said user systems.

47. The method of claim 40, further comprising the step of transferring ownership of said item directly from said owning one of said plurality of user systems to another one of said plurality of user systems by facilitator system, coupled to said computer system.

48. The method of claim 40, further comprising the step of transferring ownership of said item directly from said owning one of said plurality of user systems to another one of said plurality of user systems by facilitator system, coupled to one of said plurality of user systems.

49. The method of claim 40, further comprising the step of controlling through a facilitator system, coupled to said computer system, acquisition of ownership of said item by said owning one of said plurality of user systems.

50 The method of claim 40, further comprising the step of controlling through a facilitator system, coupled to one of said plurality of user systems, acquisition of ownership of said item by said owning one of said plurality of user systems.

51. The method of claim 40, further comprising the step of tracking ownership of said item in said virtual environment through said computer system.

52. A multi-user, distributed, interactive, virtual reality system comprising:

a computer system for generating and controlling a virtual environment; and

a plurality of user systems, coupled to said computer system, that navigate through the virtual environment and that selectively communicate with one another via said computer system.

53. The system of claim 52, wherein said communication occurs between at least two of said plurality of user systems via said computer system through the Internet.

54. The system of claim 52, wherein said communication includes voice communication.

55. The system of claim 53, wherein said communication includes voice communication.

56. The system of claim 52, wherein said communication includes gesturing.

57. The system of claim 53, wherein said communication includes gesturing.

58. The system of claim 52, wherein at least two of said plurality of user systems communicate with one another via computer system without communicating to at least one other of said plurality of user systems.

59. A selective communication method in multi-user, distributed, interactive, virtual reality system comprising a computer system and a plurality of user systems, coupled to said computer system, that navigate through said virtual environment, said method comprising the steps of:

generating and controlling said virtual environment through said computer system; and

selectively communicating among said plurality of user systems via said computer system.

60. The method of claim 59 further comprising the step of communicating between at least two of said plurality of user systems via said computer system through the Internet.

61. The method of claim 59 further comprising voice communicating means.

62. The method of claim 60 further comprising voice communicating means.

63. The method of claim 59 further comprising gesturing communicating means.

64. The method of claim 60 further comprising gesturing communicating means.

65. The method of claim 59 further comprising the step of means of communicating between at least two of said plurality of user systems via said computer system without communicating with at least one other of said plurality of user systems.

66. A multi-user, distributed, interactive, virtual reality system comprising:

a plurality of user systems that navigate through a virtual environment and that interact with one in the virtual environment; and

a computer system, coupled to each of said plurality of user systems, that maintains a state of each of said plurality of user systems as they navigate through the virtual environment.

67. The system of claim 66, wherein said computer system is coupled to each of said plurality of user systems via the Internet.

68. The system of claim 66, wherein said state includes a location in the virtual environment of its corresponding user system.

69. The system of claim 66, wherein said state includes a list of items that are owned by its corresponding user system in the virtual environment.

70. The system of claim 66, wherein said state includes a representation of its corresponding user system in the virtual environment.

71. The system of claim 66, wherein said state includes a history of tasks completed by its corresponding user system in the virtual environment.

72. The system of claim 66, further comprising a facilitator system, coupled to said computer system, that accesses said state to administrate navigation of its corresponding user system in the virtual environment.

73. The system of claim 66, further comprising a facilitator system, coupled to one of said plurality of user systems, that accesses said state to administrate navigation of its corresponding user system in the virtual environment.

74. A method for maintaining the state of a plurality of user systems that navigate through and interact with one another in a virtual environment residing on a multi-user, distributed, interactive, virtual reality system comprising a computer system, coupled to each of said plurality of user systems, said method comprising the step of maintaining a state of each of said plurality of user systems as they navigate through the virtual environment.

75. The method of claim 74 further comprising the step of coupling said computer system to each of said plurality of user systems via the Internet.

76. The method of claim 74 further comprising the step of including in said state a location in the virtual environment of a corresponding user system.

77. The method of claim 74 further comprising the step of including in said state a list of items that are owned by a corresponding user system in the virtual environment.

78. The method of claim 74 further comprising the step of including in said state a representation of a corresponding user system in the virtual environment.

79. The method of claim 74 further comprising the step of including in said state a history of tasks completed by a corresponding user system in the virtual environment.

80. The method of claim 74 further comprising the step of accessing said state by a facilitator system, coupled to said computer system, to administrate navigation of a corresponding user system in the virtual environment.

81. The method of claim 74 further comprising the step of accessing said state by a facilitator system, coupled to one of said plurality of user systems, to administrate navigation of its corresponding user system in the virtual environment.

82. A multi-user, distributed, interactive, virtual reality system comprising:

a plurality of user systems, coupled to a computer system, that navigate in a virtual environment;

a facilitator system, coupled to said computer system, that administrates and monitors navigation of said plurality of user systems in the virtual environment; and

said computer system that generates the virtual environment, that receives information from at least one of said plurality of user systems, that communicates at least a portion of said information to at least one other of said plurality of user systems, and that updates the virtual environment in accordance with said information.

83. The system of claim 82, wherein said computer system communicates at least a portion of said information to said facilitator system.

84. The system of claim 82, wherein said information includes a voice message from said one of said plurality of user systems.

85. The system of claim 82, wherein said information includes a text message from said one of said plurality of user systems.

86. The system of claim 82, wherein said information includes a position update from said one of said plurality of user systems.

87. The system of claim 82, wherein said information includes a request to acquire ownership in an item in the virtual environment.

88. The system of claim 82, wherein said computer system maintains a state of each

of said plurality of user systems in the virtual environment.

89. The system of claim 88, wherein said server system determines which representations of said plurality of user systems a particular one of said plurality of user systems perceives in the virtual environment.

90. The system of claim 82, wherein said computer system receives information from one of said plurality of user systems and distributes the information to each of said plurality of user systems.

91. The system of claim 82, wherein said computer system receives information from one of said plurality of user systems and distributes the information to a portion of said plurality of user systems.

92. The system of claim 82, wherein said computer system receives information from said facilitator system and distributes the information to each of said plurality of user systems.

93. The system of claim 82, wherein said computer system receives information from said facilitator system and distributes the information to a portion of said plurality of user systems.

94. The system of claim 82, wherein said computer system receives information from said facilitator system and said facilitator inhibits the distribution of the information to at least a portion of said plurality of user systems.

95. The system of claim 82, wherein said computer system provides a scene change to all of said plurality of users systems.

96. The system of claim 94, wherein said particular scene is provided as directed by said facilitator system.

97. The system of claim 94, wherein said computer system maintains a state of each of said plurality of user systems through said scene change.

98. The method of interaction in a multi-user, distributed, interactive, virtual reality system comprising a plurality of user systems, coupled to a computer system, a facilitator system, coupled to said computer system and said computer system, said method comprising the steps of:

generating the virtual environment by said computer system;

navigating in a virtual environment by said plurality of user systems;

administrating and monitoring by said facilitator system navigation of said plurality of user systems in the virtual environment;

receiving information from at least one of said plurality of user systems;

communicating at least a portion of said information to at least one other of said plurality of user systems; and

updating the virtual environment in accordance with said information.

99. The method of claim 97 further comprising the step of communicating by said computer system, at least a portion of said information to said facilitator system.

100. The method of claim 97 further comprising the step of including is said information a voice message from said one of said plurality of user systems.

101. The method of claim 97 further comprising the step of including is said information a text message from said one of said plurality of user systems.

102. The method of claim 97 further comprising the step of including is said information a position update from said one of said plurality of user systems.

103. The method of claim 97 further comprising the step of including is said

information a request to acquire ownership in an item in the virtual environment.

104. The method of claim 97 further comprising the step of maintaining a state of each of said plurality of user systems in the virtual environment on said computer system.

105. The method of claim 103 further comprising the step of determining on said server system which representations of said plurality of user systems a particular one of said plurality of user systems perceives in the virtual environment.

106. The method of claim 97 further comprising the step of receiving information on said computer system from one of said plurality of user systems and distributing the information to each of said plurality of user systems.

107. The method of claim 97 further comprising the step of receiving information on said computer system from one of said plurality of user systems and distributing the information to a portion of said plurality of user systems.

108. The method of claim 97 further comprising the step of receiving information on said computer system from said facilitator system and distributing the information to each of said plurality of user systems.

109. The method of claim 97 further comprising the step of receiving information on said computer system from said facilitator system and distributing the information to a portion of said plurality of user systems.

110. The method of claim 97 further comprising the step of receiving information on said computer system from said facilitator system and inhibiting by said facilitator system the distribution of the information to at least a portion of said plurality of user systems.

111. The method of claim 97 further comprising the step of providing on said

computer system a scene change to all of said plurality of users systems.

112. The method of claim 110 further comprising the step of providing said particular scene as directed by said facilitator system.

113. The method of claim 97 further comprising the step of maintaining a state of each of said plurality of user systems through said scene change.

FIG. 1

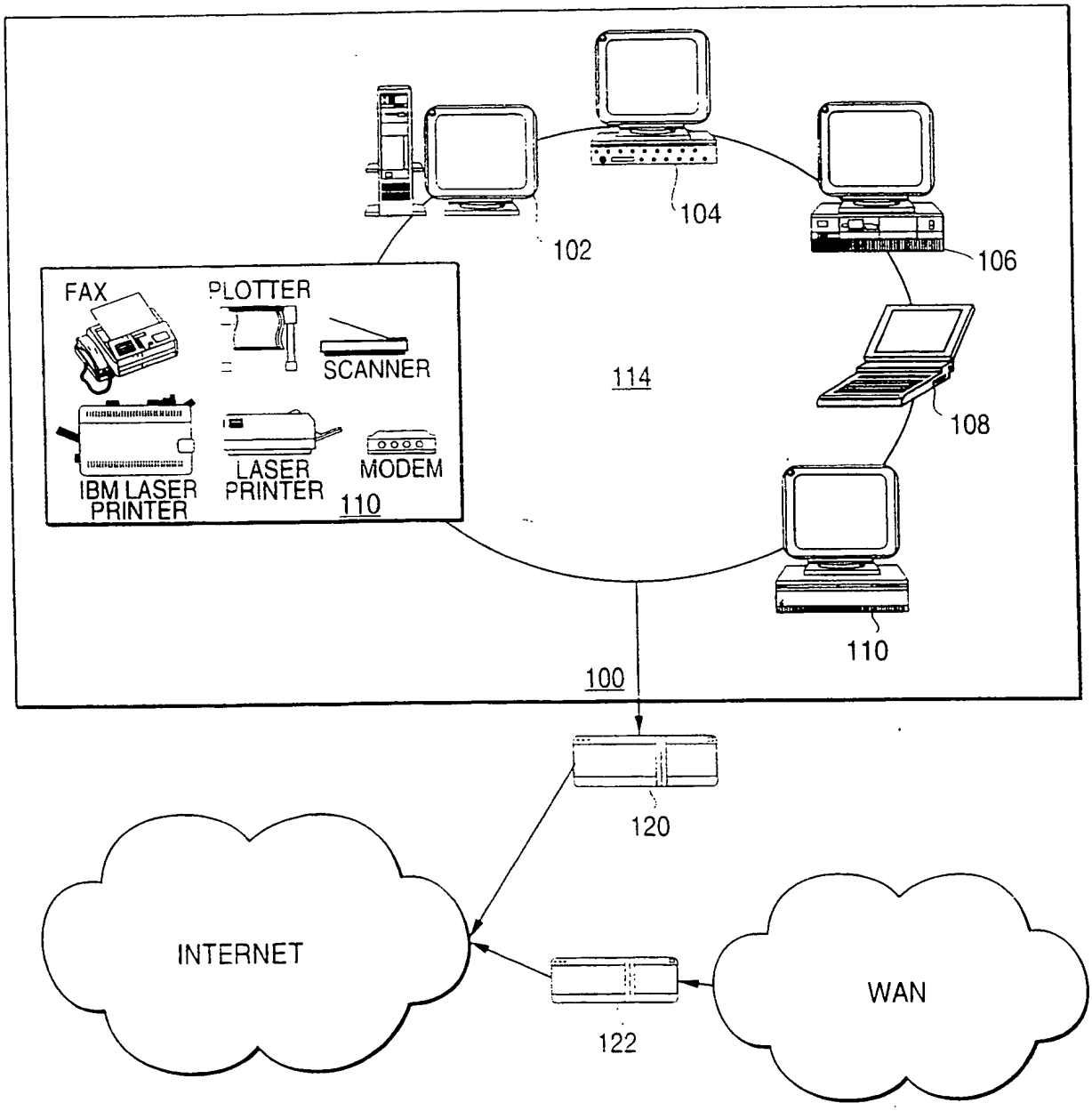

FAX
PLOTTER
SCANNER
IBM LASER PRINTER
LASER PRINTER
MODEM
110
114
102
104
106
108
110
100
120
INTERNET
122
WAN

FIG. 2

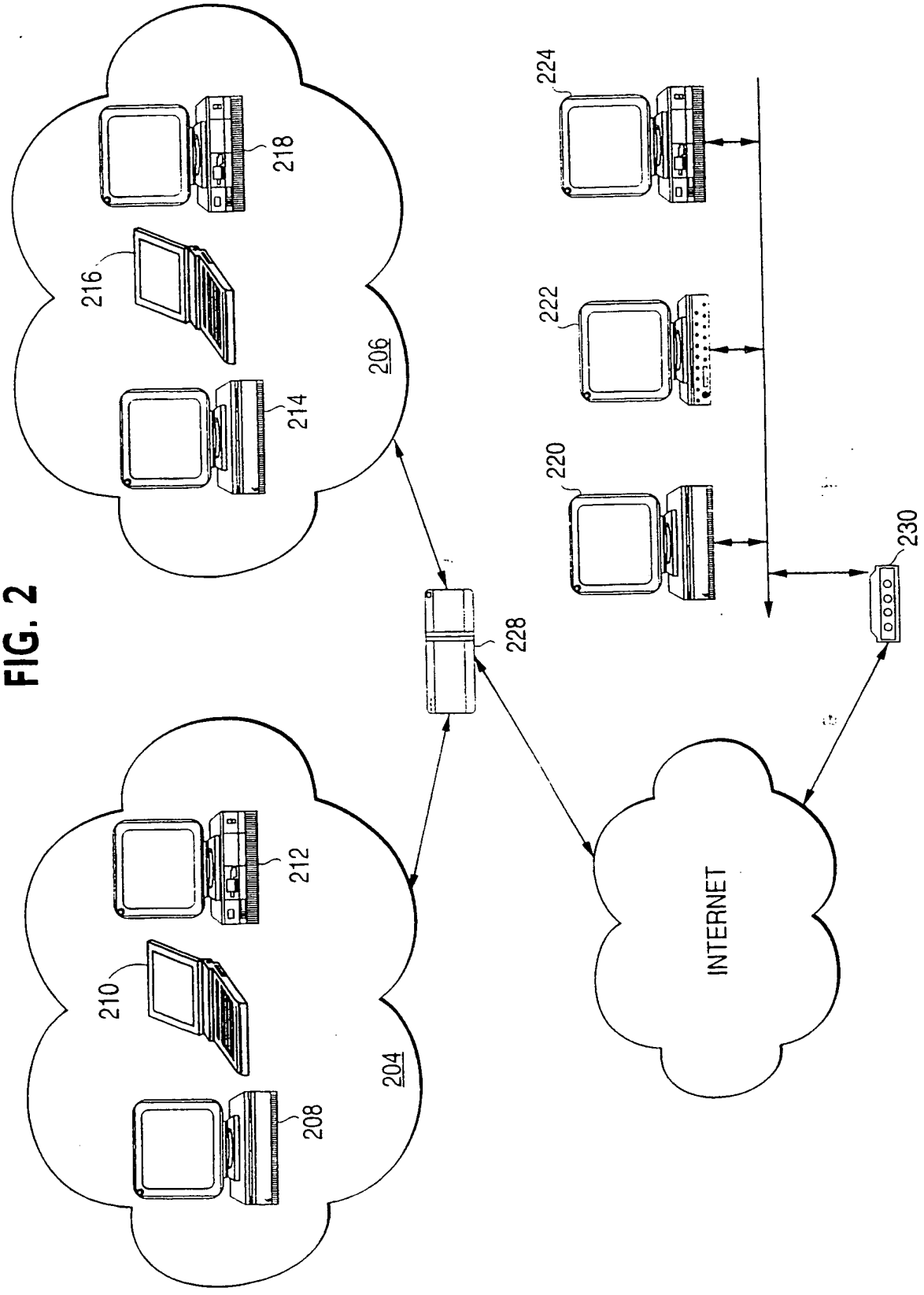


FIG. 3

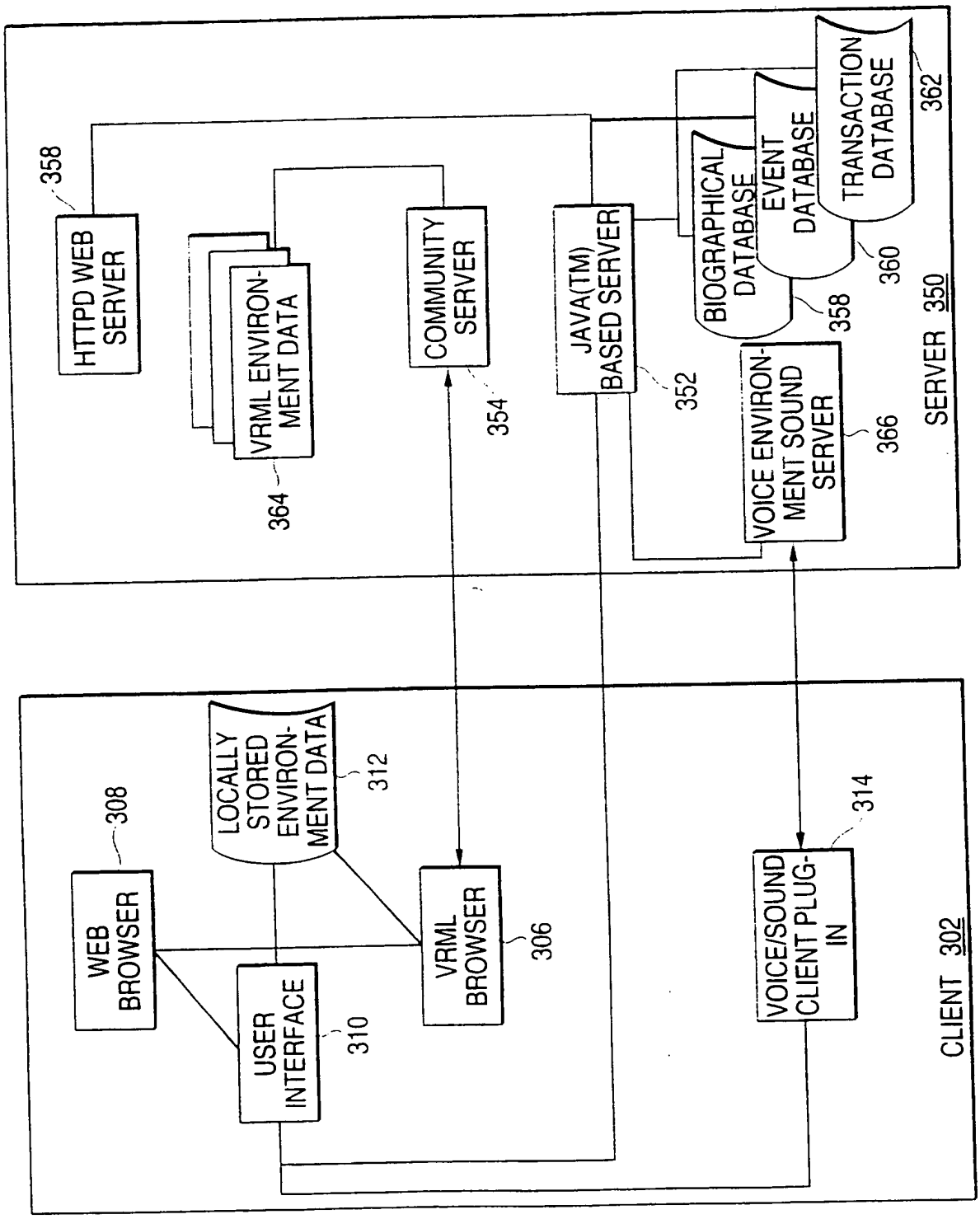

SERVER 350
HTTPD WEB SERVER
358
VRML ENVIRON-MENT DATA
364
COMMUNITY SERVER
354
JAVA(TM) BASED SERVER
352
BIOGRAPHICAL DATABASE
358
EVENT DATABASE
360
TRANSACTION DATABASE
362
VOICE ENVIRON-MENT SOUND SERVER
366
CLIENT 302
WEB BROWSER
308
LOCALLY STORED ENVIRON-MENT DATA
312
USER INTERFACE
310
VRML BROWSER
306
VOICE/SOUND CLIENT PLUG-IN
314

FIG. 4

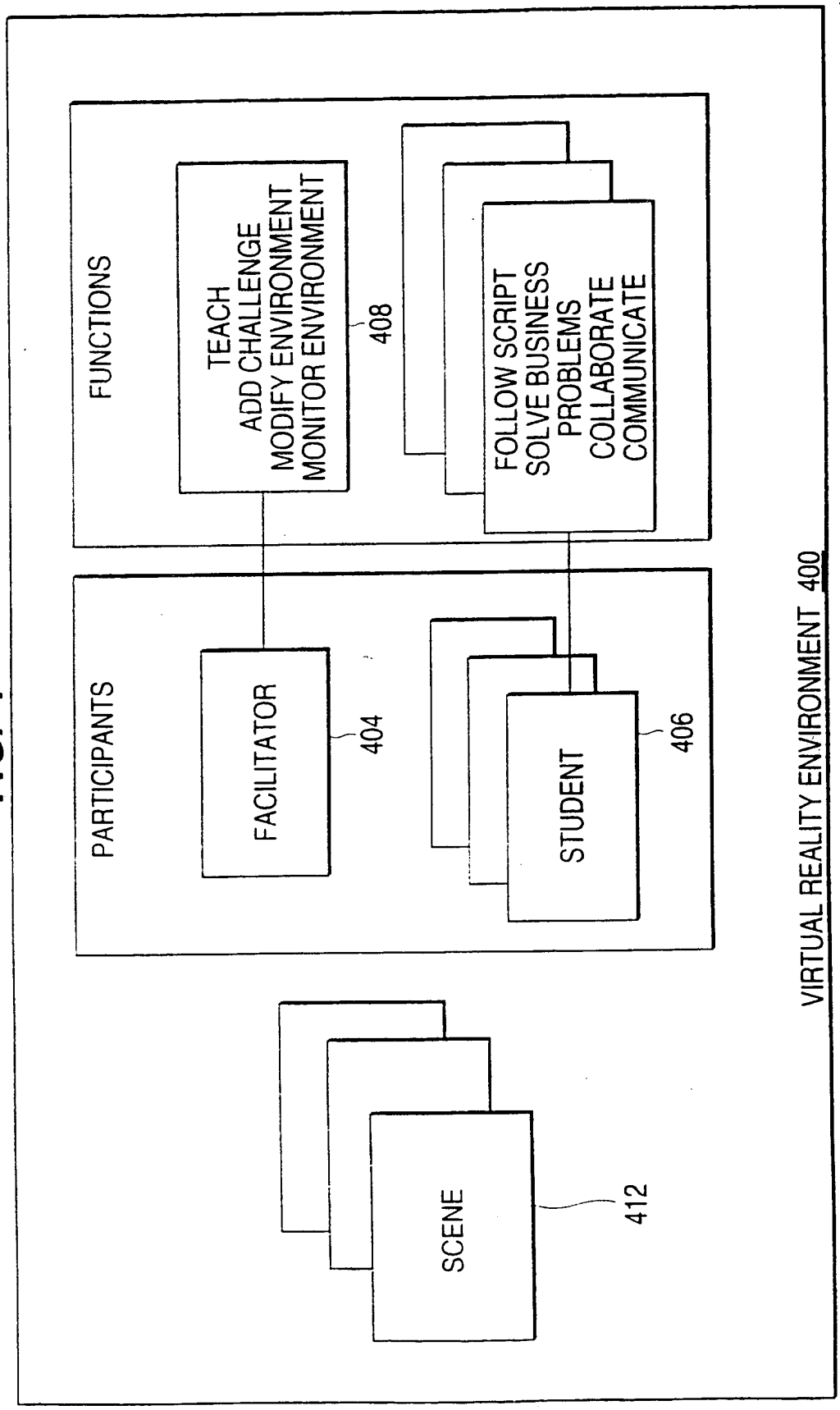

VIRTUAL REALITY ENVIRONMENT 400
FUNCTIONS
TEACH
ADD CHALLENGE
MODIFY ENVIRONMENT
MONITOR ENVIRONMENT
408
FOLLOW SCRIPT
SOLVE BUSINESS
PROBLEMS
COLLABORATE
COMMUNICATE
PARTICIPANTS
FACILITATOR
404
STUDENT
406
SCENE
412

FIG. 5A

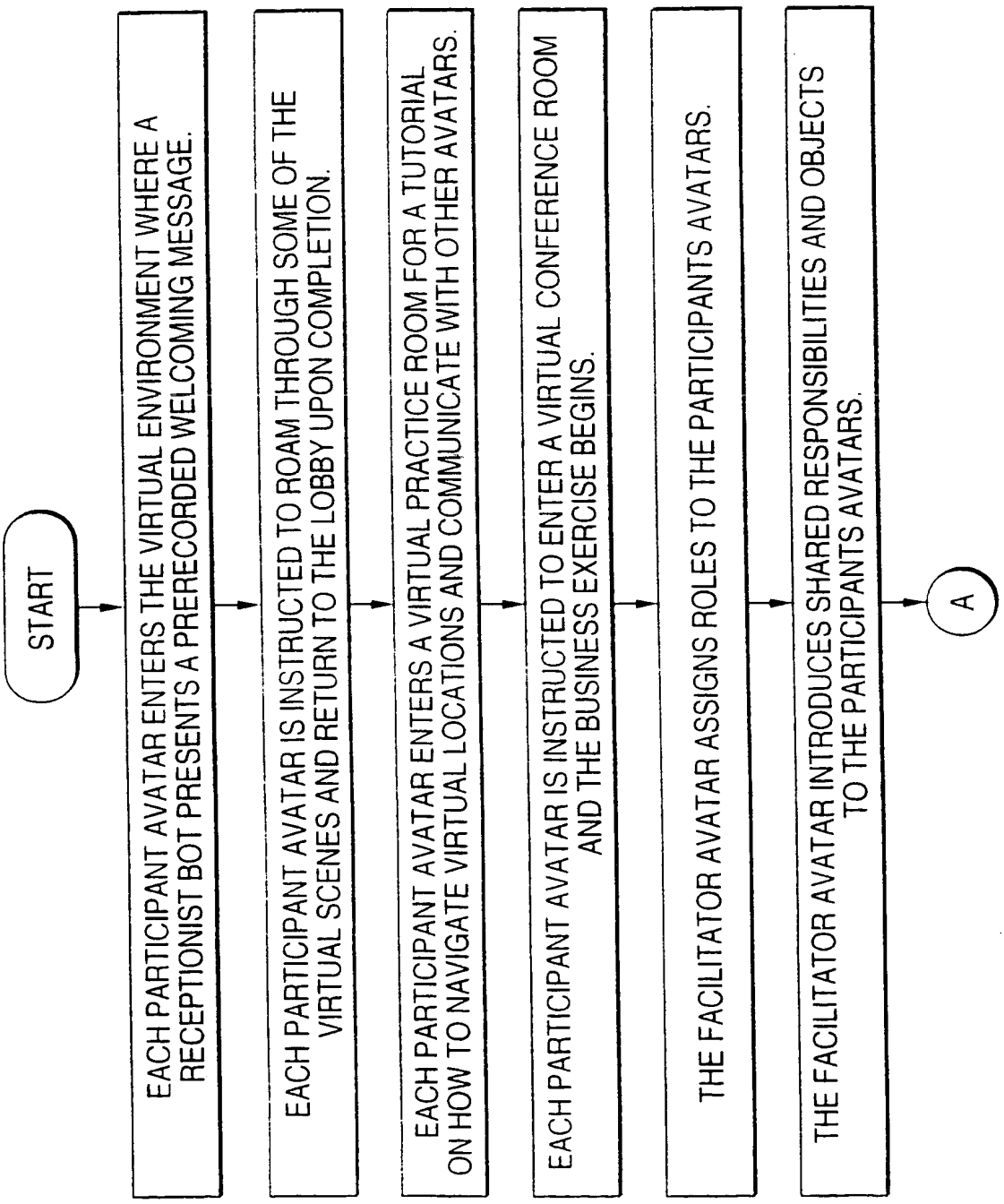
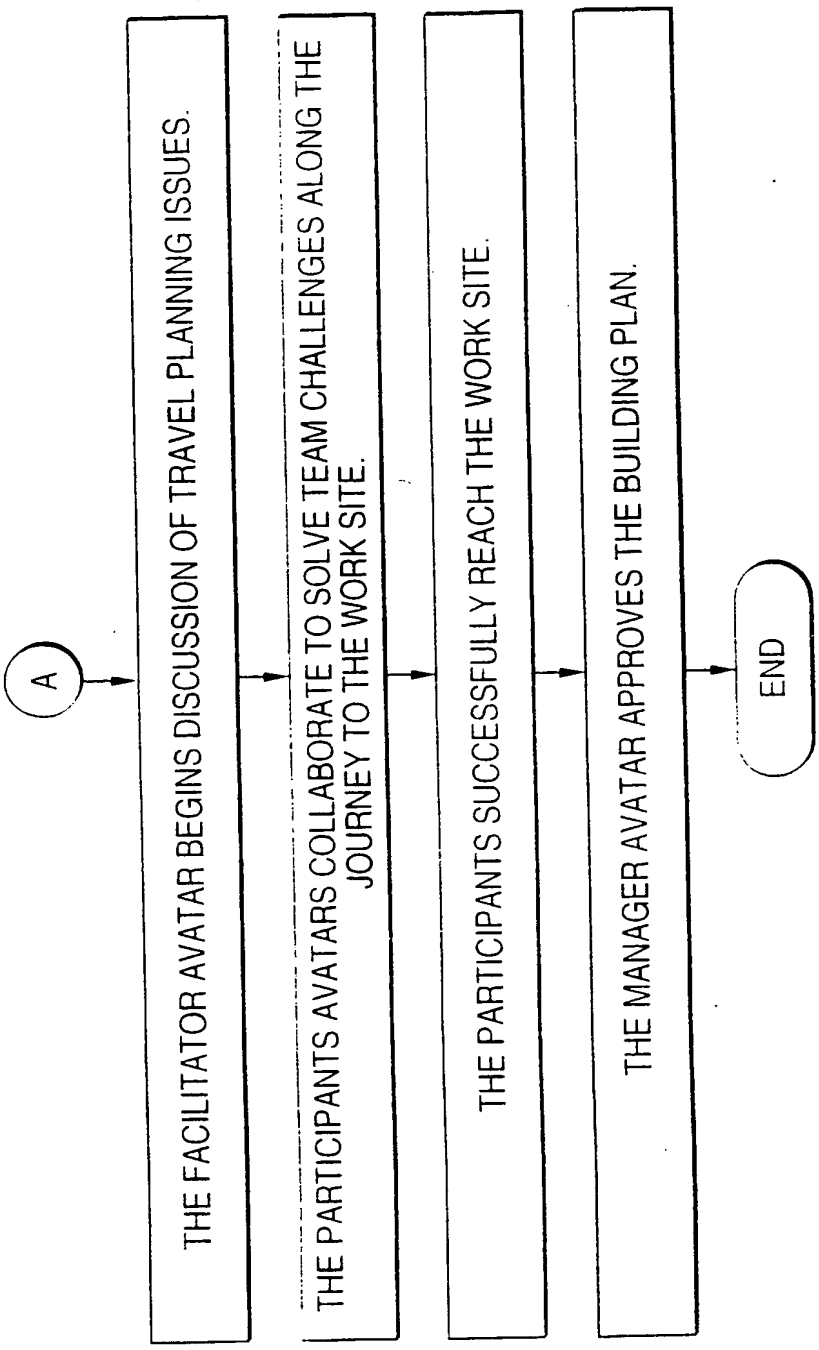

START
EACH PARTICIPANT AVATAR ENTERS THE VIRTUAL ENVIRONMENT WHERE A RECEPTIONIST BOT PRESENTS A PRERECORDED WELCOMING MESSAGE.
EACH PARTICIPANT AVATAR IS INSTRUCTED TO ROAM THROUGH SOME OF THE VIRTUAL SCENES AND RETURN TO THE LOBBY UPON COMPLETION.
EACH PARTICIPANT AVATAR ENTERS A VIRTUAL PRACTICE ROOM FOR A TUTORIAL ON HOW TO NAVIGATE VIRTUAL LOCATIONS AND COMMUNICATE WITH OTHER AVATARS.
EACH PARTICIPANT AVATAR IS INSTRUCTED TO ENTER A VIRTUAL CONFERENCE ROOM AND THE BUSINESS EXERCISE BEGINS.
THE FACILITATOR AVATAR ASSIGNS ROLES TO THE PARTICIPANTS AVATARS.
THE FACILITATOR AVATAR INTRODUCES SHARED RESPONSIBILITIES AND OBJECTS TO THE PARTICIPANTS AVATARS.
A

FIG. 5B


A
THE FACILITATOR AVATAR BEGINS DISCUSSION OF TRAVEL PLANNING ISSUES.
THE PARTICIPANTS AVATARS COLLABORATE TO SOLVE TEAM CHALLENGES ALONG THE JOURNEY TO THE WORK SITE.
THE PARTICIPANTS SUCCESSFULLY REACH THE WORK SITE.
THE MANAGER AVATAR APPROVES THE BUILDING PLAN.
END